DISCARDS AND SURVIVAL OF MARINE BENTHIC INVERTEBRATES FROM THE TRAWL METIER FOR THE EUROPEAN HAKE

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Introduction

The issue of the fishery discards is of great interest in fishery management from the new policy of the European Union 2013 ((EU) No 1380/2013) which proposes a gradual reduction of discards. Within the project (VIBAM)[1] a seasonal study between the years 2011-2012 was conducted in order to assess the discard composition with special interest in the discarding of juvenile *of Merluccius merluccius* and the invertebrate survival coming from the trawl in the Catalan Coast (Palamós). Currently In the framework of the European MINOUW[2] (H2020-SFS-2014-2) project, the works on the assessment the survival of discard continue, using the ICES WKMEDS protocols (ICES WKMEDS REPORT; 2014), with special interest in the discarding of commercial species as Norway lobster (*Nephrops norvegicus).*

1 "Viabilidad de la adaptación de invertebrados bentónicos procedentes del "by-catch" de la pesca de arrastre en el Mediterráneo catalán y sus posibles usos"
2 "Science, Technology, and Society Initiative to minimize Unwanted Catches in European Fisheries"

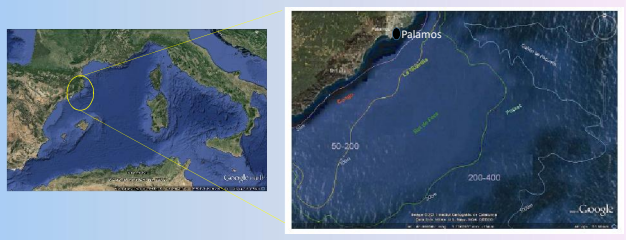

Fig 1. Study zone. Palamós continental shelf

Fig 2. from left to right: Area of experimental aquariums, *Dardanus arrosor, Diazona violacea* and *Alcyonium palmatum*

Material and methods

Four seasonal fishing samples were carried out in the fishing grounds adjacent of the Palamós in order to assess the variation in time of the discard composition and the invertebrates' survival. Discards were characterized on board by identifying the species and by calculating abundance and biomass for each one of them (fig.4). In order to determine the contribution of individual species to the average similarity between the discard samples collected in different season, a SIMPER analysis (Clarke and Warwick, 1994) was performed (Tab.1). The Invertebrates survival, instead was assessed by maintaining the specimens, coming from the fishing samples of Winter, Autumn and Spring, in an area of experimental aquariums, during an evaluation period of 96 hours (Wassenberg and Hill, 1993). The number of survivals were recorded by species (Tab. 2) and then divided for groups (Fig.5), which were used in the Chi-square analysis to test the survival differences between seasons.

Fig 3. Total catch of trawl fisheries with hake target species

Results

Discard composition

Fig 4. Total abundance and biomass by species

Note the high abundance of the *crinoid Antedon mediterranea* together with the high abundance and biomass of *A. palmatum* and *M. merluccius* below the minimum legal size (TL < 20 cm)

Merluccius merluccius below the minimun legal size (20 cm).

Nursery area and Essential Fish Habitat for *Merluccius merluccius*

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Alcyonium palmatum	11,08	11,61	5,31	31,98	31,98
Merluccius merluccius	6,53	3,59	0,86	9,9	41,87
Astropecten irregularis	5,06	3,4	1,66	9,37	51,24
Spicara sp.	3,77	2,12	0,9	5,84	57,08
Antedon mediterranea	7,07	1,92	0,88	5,3	62,38
Pteroide spinosum	1,83	1,87	3,13	5,14	67,52
Diazona violacea	4,29	1,79	0,74	4,94	72,46
Trigla sp.	2,3	1,45	0,89	4,01	76,47
Pagurus excavatus	2,46	1,39	1,78	3,83	80,3
Arnoglossus sp.	2,97	1,13	0,8	3,1	83,4
Microcosmus sp.	1,82	0,98	0,88	2,69	86,09
Liocarcinus depurator	1,25	0,83	1,78	2,29	88,38
Capros aper	3,84	0,8	0,41	2,19	90,57

Tab. 1. Simper analysis of discard composition in the four seasons

Similarity percentage of the abundance data between the four season shows a Bray-Curtis similarity of 37,7 %. The invertebrates *Alcyonium palmatum*, *Astropecten irregularis* and Antedon mediterranea, toghether with the fishes *Spicara sp.* and *M. merluccius* are the species which contribute most to the total similarity (Cumulative % of similarity > 60 %)

Survival of invertebrates

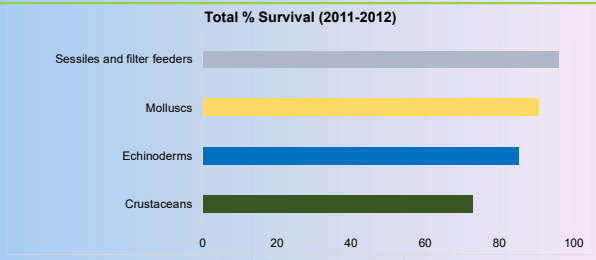

Fig. 5. Total Survival percentage (X axis) of invertebrates groups (Y axis) in Winter, Autumn and Spring

Groups	Specie	Autum n	96 h Aut	Winter	96 hWin	Spring	96 h spr	Total Start	Total After 96 h	% total Survival
Sessiles	*Phallusia mammillata*	0	0	9	9	0	0	9	9	100
	Alcyonium palmatum	13	13	15	15	5	5	33	33	100
	Diazona violacea	8	8	1	1	6	6	15	15	100
	Ascidia mentula	0	0	2	2	0	0	2	2	100
	Ascidia virginea	6	6	0	0	1	1	7	7	100
	Microscosmus sp.	2	2	1	1	0	0	3	3	100
	Pteroide spinosum	8	3	6	6	5	5	19	14	73,68421053
Molluscs	*Cassidaria thyrrena*	1	1	0	0	0	0	1	1	100
	Cassidaria echinofora	2	2	1	1	3	3	6	6	100
	Naticidae	5	5	0	0	0	0	5	5	100
	Calliostoma granulatum	5	2	2	2	1	1	8	5	62,5
Echinoderms	*Echinus melo*	0	0	1	1	0	0	1	1	100
	Marthastheria glacialis	1	1	0	0	0	0	1	1	100
	Brissopsis lyrifera	1	1	0	0	0	0	1	1	100
	Astropecten aranciacus	1	0	5	5	0	0	6	5	83,33333333
	Ophiura texturata	0	0	23	10	0	0	23	10	43,47826087
Crustaceans	*Maja sp.*	0	0	1	1	0	0	1	1	100
	Macropodia longipes	0	0	1	1	0	0	1	1	100
	Liocarcinus depurator	1	1	6	1	1	1	8	3	37,5
	Pagurus excavatus	4	4	12	0	1	1	17	5	29,41176471
	Medoripe lanata	2	2	1	0	0	0	3	2	66,66666667
	Dardanus arrosor	2	2	12	10	0	0	14	12	85,71428571
	Astropecten irregularis	38	31	7	3	6	6	51	46	90,19607843

Tab. 2 Number of individuals, per species, per season ,initial and survivors after 96 hours, and the total percentage of the survival.

Almost all sessile and filter feeder's species except *Pteroide spinosum* (73,68%), have a 100% of survival after 96 hours. Molluscs have similar results and only the *Calliostoma granulatum* have a survival less than 100% (62, 5%). On the other hand, crustaceans and echinoderms show highest mortality, exceeding the 50% in some species.
Results of the Chi-square tests showed that only the crustaceans' survival differed significantly between seasons (p-value<0.001, chi-squared value=25.398, df=2), displaying the lower survival value in Winter (40%).

Conclusions

1º The occurrence of the European Hake juveniles (TL < 20 cm) throughout the year in the fishing ground of the Palamos continental shelf indicates that this could be an important nursery area in which the soft coral *Alcyonium palmatum*, the Crinoid of *Antedon mediterranea* and the starfish *Astropecten irregularis* play an important role.

2º Most invertebrates species used in the experiment have high survival rate (>80%). In terms of groups, the higher survival rate (>90 %) were found for the groups Mollusks and Sessile while crustaceans followed by the echinoderms have the lower ones.

References
1 - REGULATION (EU) No 1380/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 on the Common Fisheries Policy
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Biodiversity/Fishing impacts

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VIBAM MINOUW